National Institute of Environmental Health Sciences

Impact of summer droughts on water quality of the Rhine River - A preview of climate change?

Author(s): Zwolsman JJG, van Bokhoven AJ
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Abstract:

It is generally recognized that climate change will affect the discharge regime of the Rhine River. Especially the anticipated increase in extreme river discharges (floods and droughts) poses serious problems to water management, both with regard to water quantity and water quality. Water quality effects of climate change are not sufficiently recognized, however. The purpose of this study is to investigate the impact of droughts on the water quality of the River Rhine. Time series of river flow and water quality were analyzed for station Lobith, located at the Dutch-German border. Over the past three decades, three major droughts were identified, occurring in the years 1976, 1991, and 2003. The water quality during these dry years was compared with the water quality in reference years, characterized by average hydrological conditions and similar chemical pollution. Four groups of water quality parameters were investigated: 1, general variables (water temperature, dissolved oxygen, chlorophyll-a); 2, major ions (chloride, sodium, sulfate, fluoride, bromide); 3, nutrients; and 4, heavy metals. It was found that water quality is negatively influenced by (summer) droughts, with respect to water temperature, eutrophication, major ions and heavy metals. Effects on nutrient concentrations were small for ammonium and could not be demonstrated for nitrate, nitrite and phosphate. The decline in water quality during summer droughts is both related to the high water temperatures and to low river discharges (limited dilution of the chemical load from point sources). Moreover, the impact of the 1976 drought on water quality was far more important than that of the 2003 drought, indicating that the impact of droughts on water quality will be greater when the water quality is already poor.

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Resource Description

Exposure : ☒

weather or climate related pathway by which climate change affects health

Extreme Weather Event, Food/Water Quality

Extreme Weather Event: Drought

Food/Water Quality: Chemical

Geographic Feature: ☒

resource focuses on specific type of geography

Freshwater

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : Netherlands;Germany

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Resource Type: ☑

format or standard characteristic of resource

Research Article

Timescale: ☑

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content